Economical Approach to Providing Electrical Power to Unmanned, Remote Sites Developed

Payoff

A new propane-fired generator, based on an advanced conversion technology, can produce electric power at one-fourth to one-seventh the cost of generators presently used by the DoD at unmanned, remote sites. Implementation of this technology would reduce fuel costs for Air Force unmanned sites by a factor of four.

Accomplishment

A team led by the Propulsion Directorate developed a propane-fired generator based on alkali metal thermoelectric conversion (AMTEC) that has a system efficiency 4 times that of present propane-fired thermoelectric generators (TEGs). This team, which included Advanced Modular Power Systems Inc., NASA Lewis Research Center and the Directed Energy Directorate, performed a study of technologies to determine the safest, most reliable and most economical approach to supplying electrical power at remote, unmanned sites.

Background

The DoD operates a number of unmanned sites in remote areas of the world (such as the Arctic and Antarctic regions) that must be serviced by maintenance crews flown in by helicopter. Their remoteness contributes to high helicopter accident rates and high operational and logistic costs (cost of transporting propane to a site in the Alaskan environment is $35 per pound). The team had initially identified radioisotope thermoelectric generators (RTGs) as the best approach to supplying electric power for remote, unmanned sites. The RTGs, however, were eliminated as viable replacements due to issues arising from fear of radioisotope contamination and the strong possibility that economically acceptable radioisotype fuels would be unavailable to refuel the RTGs when they dropped below acceptable power output ratings. A study of over 50 sites performed by the Directorate (which included a survey of the Air Force Technical Applications Center's seismic observatories in Alaska) found that current TEGs were operating on 30 year old technology and had system heat-to-electric conversion efficiencies ranging from 2 to 4 percent (5,000 pounds of propane were required to operate a 60 watt light bulb for one year). Assuming that 60 percent of the electrical power required for these sites could be generated with solar cells, the higher efficiency AMTEC-based generator would save the Air Force about $5,000,000 per year in air transport expenses alone.